It seems likely that the crystallized protein is identical with the starting material; a final identification cannot, however, be established without careful examination of other properties than the crystalline habit.

¹ Hopkins, F. G., *Nature*, 126, 328 and 383 (1930).

² Clark, J. H., *J. Gen. Physiol.*, 27, 101 (1943), and 28, 539 (1943).

³ Linderström-Lang, K., Hotchkiss, R. D., and Johansen, G., *Nature*, 142, 996 (1938).

⁴ Sørensen, S. P. L., and Sørensen, M., *C.R. Lab. Carlsberg*, Ser. Chim. 23, 7, 86 (1939).

THE NATURAL VEGETATION OF TRINIDAD

IN a work bearing this title*, Dr. J. S. Beard has given a comprehensive and interesting account of the vegetation of the untouched forest regions of the island of Trinidad, B.W.I. In general, this work follows the earlier survey of R. C. Marshall and brings to the notice of the reader literature which has contributed to a knowledge of the ecology of this region. The underlying practical reason for this study, namely, the correct utilization and conservation of the remaining areas of unalienated Crown land, follows a long period of *laissez-faire* during which there was no effective official policy and when, as in many other tropical regions, the harmful utilization of virgin areas was all too common.

The present survey is both thorough and readable. It gives a clear account of the uniquely interesting position of Trinidad—an outlier of the South American continent, rather than the southernmost member of the Antilles—and of the factors which enter into the ecological situation. It might almost be said that if what you want is an adequate introduction to the vegetation of tropical America, you should begin with Trinidad. The advantages are numerous. The island, roughly about the size of an English county, has a rich flora (upwards of 2,200 angiosperms), many being representative of the mainland. On the whole this flora is now sufficiently well known, and herbaria are available for consultation. The data of considerable soil surveys are also available: no less than twenty-three types have been enumerated, which for ecological purposes can be classed into three groups in terms of drainage—a conception of which much use has been made in Beard's studies. Other relevant data, topographical, geological and meteorological, are also at hand and are summarized in the present work.

The total of endemic species in the entire flora is estimated at 7 per cent—a low figure for an island flora. The evident close affinity of the Trinidad flora is with the rich adjacent South American region; affinities of a more remote kind with the flora of West Africa can also be traced.

The present work is chiefly concerned with the tree flora. Although a considerable part of the original forested area has been cleared for cultivation, much still remains in its native state, the influence of man being entirely local in nature. A check list of trees is followed by a classification of the plant communities. The six formations which are recognized, seasonal, dry evergreen, montane, intermediate, swamp and marsh formations, are based on climatic and edaphic factors. Each is treated in detail and illustrated by diagrams and some good photographs. Space does

not permit of any account being given of this considerable section of the memoir: the overall result is, however, excellent, and the reader, and still more the visiting botanist, will be able, in a short space of time, to gain a real insight into the components of this rich and varied region.

In the concluding section the author analyses and discusses the relationships observed and the ecological conceptions which emerge. In particular, he is concerned with the correct application of certain terms—the names of the several floristic groups—and with concepts such as the nature of the climax. Of the climatic climax he writes as follows:

"In the tropics, studies have shown repeatedly that it is the moisture-supplying ability of the soil which is the most important consideration and this is not necessarily at all closely concerned with climate. The writer's classification of the formations into six series is based entirely on moisture relations which result from the interplay of the three factors of climate, topography, and soil. The ecosystem, in fact, is one and indivisible. Climate, however, is the only component factor of the ecosystem which for any given area is constant (or presumably more or less constant). Land-form and soil, and with them the vegetation, pass through young, mature, and senile stages of development. Within any climatic region or zone, therefore, at some point in the cycle of development a formation will appear which can be interpreted as the highest type of vegetation which can develop under the given climate, other environmental factors (land-form, soil) having at the same time developed the most favourable moisture conditions possible to them in the cycle. The writer believes this to be a more workable definition of the climatic climax.

"As so defined, the climatic climax will not necessarily be the highest type which can exist in the given climate, for such a type would only appear in the presence of ideally favourable conditions of soil and topography. This definition permits of the existence of more than one equivalent climatic climax within a given climate, according to differences in the land-form/soil complex."

A final section is devoted to a reconstruction of the palæo-ecology of the island. The author is to be congratulated on a valuable piece of work in which the reader's interest is sustained throughout.

C. W. WARDLAW

TRAINING FOR CHEMISTS

THE Education Committee of the British Association of Chemists has recently published its suggestions on the education of chemists*, and though the report does not contain any strikingly novel proposals, it is full of sound sense and should be carefully studied in both academic and industrial chemical circles. The Committee points out that practically the whole of the industry of Britain is dependent on scientific control: a platitude, no doubt, to men of science, but a fact that still has to be emphasized, and emphasized repeatedly, for a general public to whom science is even yet an arcanum. To implement this control a steady and increasing flow of scientific men, and particularly chemists, is essential, and the Committee considers

* Oxford Forestry Memoirs, No. 20, 1945. Pp. 152, with coloured map and 46 illustrations. (Oxford: Clarendon Press, 1946.)

* Education in Chemistry: the Teaching of Chemistry in Schools and the Training of Chemists and Chemical Technicians for Industry. (London: British Association of Chemists.) 2s. net.

the education of chemists under the headings of chemistry in schools, chemistry at the university and the technical college, the training of chemists and chemical technicians engaged in industry, and the recruitment and training of teachers of chemistry.

The report has little to say about the inherent value of science as part of a liberal education, confining itself to the bare assertion that the study of science is of direct cultural importance. This aspect could usefully have been treated more fully, for even to-day it remains true that in a great many schools science is regarded as on a lower educative plane than the so-called humanities. A strong lead from the British Association of Chemists would have found wide support from science masters and mistresses, and since the fundamental education of chemists is given in the schools, the tone should have been pitched high from the start. The report does, however, make many valuable observations on school science, especially the remark that there is sometimes too much insistence on 'the spirit of science' and too little on providing in an assimilable form an essential basis of facts and their relationship. This is a fully justified charge: the pendulum has, indeed, swung to the opposite extreme from the old South Kensington days, and university chemistry teachers have good reason to complain of the lack of factual knowledge shown by freshmen. Though the report does not specifically refer to it, one contributory cause of this situation, so far as chemistry is concerned, is the neglect of qualitative analysis in the schools: analysis admittedly requires a great deal of time, but it does make the student familiar with the materials of his craft.

On types of school, the report refers to the suggestion in the White Paper on Education that at eleven, and at thirteen, pupils should be allocated to one of the three kinds of secondary school—grammar, modern or technical. This suggestion is regarded as unsound, because no preference is shown by most pupils at these ages; instead, the Committee recommends that the three proposed types of school should be divisions of one multilateral institution under the general control of the same board of governors and arranged if possible on the house system. The chief advantage claimed for this system is a social one; it would help to prevent the development of superiority or inferiority complexes surrounding the type of child in a particular grade of school. The Committee agrees that there is a case for grouping pupils at about the age of thirteen into classes of differing intellectual abilities, but makes the very sound point that this grouping should be such as to allow those who learn quickly to make more rapid progress in a common curriculum than to divide children into classes taking widely different courses.

On the question of external school examinations, the Committee feels that some such test at School Certificate age should be maintained, since industry and society require some datum line on which they can base an initial estimate of educational attainment, and an internal standard must inevitably vary from school to school. The test should, however, be conducted in such a way as to yield an estimate of general intelligence rather than of an ability to reproduce set problems and books. After the school minimum leaving age, the Committee recommends for all pupils the continuation of a general course in certain compulsory subjects, including science, with a choice of others, such as languages, handicrafts, and so on. The basic subjects common to all would be

English, science, mathematics, a modern language, history and geography, with the addition of Latin for potential science specialists if it has not been studied previously.

As to the Higher Certificate, the Committee feels, like so many of us, that the whole basis of the examination should be broadened, and that the certificate should not exempt the student from the first-year course at a university. Similarly, scholarship examinations should not be tests to discover how far candidates have already progressed towards their degree, but should be a means by which those most capable of profiting by further education on more specialized lines may be selected.

At the university and technical college, the report continues, the science student must have time to make contact with students in other faculties and sufficient leisure to follow some cultural interests. This would probably involve an increase from three years to four years in the normal pass degree course, and is particularly necessary in chemistry if the proper background to the subject is to be imparted.

Further suggestions by the Committee include closer co-operation between the universities and the chemical industry, a modification in the conditions of military service for undergraduates, the formation of training centres for technical grades, better prospects for junior employees, an improved financial standard of remuneration for chemists and the encouragement of well-qualified teachers. The report ends with an appeal to all the organisations now representing the craft of chemistry to make a common approach to the whole subject.

E. J. HOLMYARD

ECHINODERM FAUNA OF AUSTRALIA

DR. HUBERT LYMAN CLARK'S large work, "Echinoderms from Australia", was reviewed in *Nature* of September 24, 1938. That review and the obituary notice of Dr. Clark in *Nature* of September 20, 1947, show how many and how important were his contributions to the knowledge of Australian echinoderms. He had made them his peculiar province; it is fitting that they should be the subject of his *chef-d'œuvre*, "The Echinoderm Fauna of Australia: its Composition and its Origin"*, which was published in 1946 and has now reached Great Britain. For it he received on his deathbed the award of the Australian Clarke Medal.

Part 1, which is by far the greater part of the volume, is an account of all the echinoderms, living or extinct, which are known from Australia. There are keys to all orders, families, genera and species; and, under each species—and there are nearly nine hundred of them—notes on synonymy, range, occurrence, habitat, habits, colour, variation and food so far as they are known. There are no illustrations, since nearly all the species have been figured elsewhere, and references to those figures are given.

Part 2 is a discussion of the composition and origin of the Australian echinoderm fauna. Its most characteristic feature is the predominance of East Indian forms and influences, so that there can be no doubt it is derived from there. It appears to have

* Carnegie Institution of Washington, Publication No. 566. The Echinoderm Fauna of Australia; its Composition and its Origin. By Hubert Lyman Clark. Pp. iv + 567. (Washington, D.C.: Carnegie Institution, 1946.) 4 dollars.